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CORPORATE FINANCIAL POLICY, TAXATION, AND MACROECONOMIC RISK

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ABSTRACT

This paper develops a simple model of corporate financial structure intended to formalize the macroeconomic concern over excessive leverage. In particular, we attempt to rationalize why firms designing an optimal capital structure would choose a level of debt that leaves them heavily exposed to macroeconomic risk. Our starting point is a variant of the "corporate control" model often used to motivate debt as the optimal financial contract. We modify this framework in two ways. First, we include common risks, interpretable as business cycle risks, as well as idiosyncratic risks. Second, we include corporate and investor-level taxes, and consider the implications of a net tax bias against equity finance. The tax distortion confronts firms with a tradeoff ex ante between the costs of equity finance and the costs of increased exposure to macroeconomic risk accompanying debt finance. In this regard, an equilibrium with "excessive leverage" is possible. Further, despite the possibility of renegotiation, debt is in general less effective than equity in insulating the firm against aggregate risk.

Our model leads to the prediction that individual firm dividends may vary with macroeconomic conditions, even after controlling for the effects of relevant firm-specific performance measures, such as earnings. We present some formal econometric evidence in support of this prediction, using a panel of individual corporations. Evidence on some related predictions is also presented.

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I. INTRODUCTION

The significant rise in corporate borrowing in the 1980s has renewed interest both in the determinants of corporate leverage and in the implications of high leverage for macroeconomic stability. In the process, it has stirred a lively debate. Many financial economists point to the benefits of high leverage in restricting non-value-maximizing behavior by managers (see for example Jensen, 1986, 1988). On the other hand, a number of macroeconomists have expressed concern over whether the increased leverage makes firms excessively vulnerable to a downturn (see for example Bernanke and Campbell, 1988; and Friedman, 1986, 1990).

Underlying the macroeconomic concern is the idea that, somehow, the existing corporate financial structure is not designed to insulate firms optimally against the risk of the business cycle. In this paper, we develop a simple model of capital structure intended to formalize this possibility. We attempt to rationalize why firms designing an optimal capital structure may choose ex ante a level of debt that leaves them heavily exposed to macroeconomic risk.

Our starting point is a variant of the "corporate control" model often used to motivate debt as the optimal financial contract.[1] We modify this framework in two key ways. First, we include common risks to firms, interpretable as business-cycle risks, as well as idiosyncratic risks. In this kind of setting, incentive considerations dictate that the firm should bear the idiosyncratic risk, but that the outside lenders should absorb the aggregate risk. As a consequence, the optimal contract is no longer pure debt, but a mixture of debt and equity, where equity is the mechanism through

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[1]For a survey of corporate control models of debt, see Harris and Raviv (1991).

which the firm shifts (at least some of) the aggregate risk to its creditors. Second, we include corporate and investor-level taxes, and consider the implications of a net tax bias against equity finance. The tax distortion confronts firms with a tradeoff ex ante between the costs of equity finance and the costs of increased exposure to macroeconomic risk accompanying debt finance. In this regard, an equilibrium with "excessive leverage" is possible. Further, despite the possibility of renegotiation, debt is never effectively "equity in drag." As we demonstrate, even when costless renegotiation is feasible, debt cannot in general perfectly substitute for equity as a means of insulating a firms' real activities against aggregate risk.

Our analysis differs from the traditional approach to studying debt and taxes (e.g., Gordon and Malkiel, 1981) by emphasizing the distinction between aggregate and idiosyncratic risks. Indeed, if the only risks to the firm are idiosyncratic, then the tax bias against equity tax does not distort the captial structure choice; pure debt finance is optimal for incentive reasons, as well as tax reasons. Tax considerations confront the firm with a meaningful tradeoff only when aggregate risks are present.[2] We also differ by explicitly considering whether the the possibility of renegotiation makes the tax distinction between debt and equity irrelevent.

Perhaps the key element of our theory is the role of equity in permiting firms to share aggregate risks with its creditors, as way to minimize the possibility of recession-induced financial distress. As we demonstrate, this leads to the prediction that individual firm dividends may vary with macroeconomic conditions, even after controlling for the effects of relevant

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[2]Relatedly, while the tax bias distorts the firm's mix between debt and equity finance, it is not essential to explaining the existence of debt. Corporate control considerations serve this function.

firm-specifc performance measures, such as earnings. We present some formal econometric evidence in support of this prediction, using a panel of indvidual corporations. Independently of firm-level variables, macroeconomic conditions are significant predictors of dividends. These results are robust to a variety of different proxies for macroeconomic conditions.

The paper is organized as follows. We introduce the assumptions of the basic model in section II, and then characterize the optimal financial arrangement and equilibrium behavior in section III. To ease the exposition we first develop the analysis under the assumption that renegotiation of debt is arbitrarily precluded. We then drop this restriction, and demonstrate that the basic results remain unaffected. In section IV, we provide evidence on two of the model's basic implications: the macroeconomic effect on individual firm dividend policy, and the connection between captial structure and the aggregate rate of involuntary business liquidations. We also attempt to quantify the role of equity in sharing aggregate risk by examining the cyclical behavior of the "equity cushion," the ratio of dividends to interest payments. Finally, we discuss the relation of the model to the increase in corporate debt during the 1980s and, as well, to the recent trend away from debt finance. Concluding remarks are presented in section V.

II. THE FINANCIAL CONTRACTING PROBLEM: SETTING

The model characterizes a sector of the economy consisting of many risky firms that are identical ex ante. There are three periods -- 0, 1, and 2. Each firm operates a project that involves potentially three stages. One unit of input is required in period 0. In period 1, the option of suspending the project arises. The liquidation value (in units of period 2 output) is $\omega < 1$. If instead the project is continued, it yields a random level of output in period 2.

There is a both an aggregate and an idiosyncratic component to project risk. The aggregate shock is realized in period 1, prior to the liquidation decision. It is summarized by a (common) success probability p, drawn from a continuous probability distribution: $p \in [\underline{p},\bar{p}]$, with $0 < \underline{p} < \bar{p} < 1$; and H(p) and h(p) are the respective cumulative distribution and density functions. Presuming the project is not liquidated in period 1, the outcome of idiosyncratic risk is then realized in period 2. Output for each project equals y with probability p and 0 with probability 1 - p. Thus aggregate conditions govern the period 1 conditional mean of period 2 output, equal to py, while idiosyncratic factors govern the ex post realization about the mean. We assume further that

$$\underline{p}y > \omega \tag{1}$$

which, since $\underline{p}$ is the lowest possible realization of p, implies that liquidations are never socially efficient.

Each firm's objective is to maximize its expected discounted return. It obtains financing in period 0 from risk-neutral lenders. Under symmetric information, the overall outcome is simple to characterize. As long as the unconditional mean of project output exceeds the gross riskless interest rate r (i.e, as long as $\int_{\underline{p}} py\, h(p)dp \geq r$) it is optimal to initiate the project. Condition (1) ensures that the project should not be liquidated prematurely, regardless of the realization of the aggregate state. Finally, financial structure is irrelevant and indeterminate. Any security which offers lenders an expected return equal to r will suffice.

To motivate a meaningful role for financial structure we introduce the following agency problem. Suppose that after the aggregate state is realized in period 1, each firm has the option of secretly using the invested capital for its own purposes. The period 2 payoff from this malfeasant behavior is ν, and is unobservable by outsiders. The trade off is that the misallocation of funds guarantees an unsuccessful project outcome. This scenario is a simple formalization of the story which Berle and Means (1932), Jensen (1986, 1988), and others have used to motivate a divergence of objectives between ownership and management. We place the following restrictions on the relative size of ν:

$$\nu < \omega \tag{2}$$

$$\nu > \underline{p}y - \omega \tag{3}$$

The significance of these two restrictions will be taken up later.

In period 0, each firm issues securities to lenders. The securities specify (i) a decision rule for whether to liquidate or to continue after period 1, and (ii) a set of state-contingent payments. Observables upon which the contract may be conditioned include the common shock p and, if the project continues, the idiosyncratic output realizations. Importantly, it is not possible to include contingencies based on the allocation of invested capital, since this activity is not publicly observable.

To address tax considerations, we divide the set of feasible state-contingent securities into two kinds: "debt" and "equity." The Internal Revenue Service requires that to be classified as debt, a security must offer an interest obligation that is "sum certain." The standards imposed by the sum certain requirement are somewhat vague since the tax code does permit debt to involve some risk. Roughly speaking, the security must offer (i) a fixed payment, except in the event of distress; and (ii) liquidation and seniority rights.[3] With these considerations in mind, we assume that a debt contract specifies a face value obligation D and a liquidation rule. The contract gives the bondholders the right to liquidate whenever expected earnings are below the point where the firm can credibly commit to managing the project efficiently (see below).[4] This amounts to specifying a reservation value for the aggregate disturbance p; call it p_0. If $p < p_0$, the debtholders liquidate the firm and receive the proceeds ω (since they are senior claimants). If instead $p \geq p_0$, production proceeds and the bondholders are paid D if the outcome is good and nothing if it is bad.[5] Given that lenders are risk-neutral, the expected payoff to debt must satisfy

$$(1-t)[\int_{p_0} pD\cdot h(p)dp + H(p_0)\ \omega] = (1-t)\psi r \quad (4)$$

where t is the personal income tax rate and ψ is the fraction of the project that is financed by debt.[6]

A commonly held view is that equity offers firms more flexibility than debt in times of distress. We capture this idea by assuming that equity

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[3] See the discussion in Bulow, Summers, and Summers (1990) and Gertler and Hubbard (1990).

[4] In our formulation, debt is a two period contract. It is initiated in period 0; there is a call provision in period 1; and final payoffs (in the absence of liquidation) occur in period 2. An equivalent and perhaps more realistic formulation is to think of the financial arrangement as a sequence of one period contracts. At the end of period 1, the bondholders decide whether to roll over the debt for another period or sue for liquidation. The liquidation rule is based on the realization of p.

[5] It is straightforward to verify that it is optimal for creditors to receive 0 in the bad productivity state. We embed this result a priori simply to conserve on algebra.

[6] We model taxes as being levied on gross returns for simplicity of exposition. The results are not affected by imposing taxes on net returns. In the absence of an investment model with long-lived capital, any assumptions about depreciation for tax purposes would be somewhat artificial. To focus on the capital structure issues central to our analysis, we avoid discussion of depreciation accounting.

payoffs may be indexed to the observable common shock. In particular, an equity contract pays a "dividend" E^p if the project outcome is successful and the realized aggregate state is p; and it pays nothing otherwise. Implicit in this formulation is that equityholders have no liquidation or seniority rights. To offer a competitive return, the expected return on equity must satisfy

$$(1-t^e) \int_{p_0} p\, E^p \cdot h(p)dp = (1-t)(1-\psi)r \tag{5}$$

where t^e is the personal tax rate on equity, and $(1-\psi)$ is the fraction of the project financed by equity.

Each firm maximizes, net of taxes, expected final output minus payments to bondholders and equityholders. This objective, $V(p_0,D,E^p)$ is given by

$$V(p_0,D,E^p) = (1-t^c) \int_{p_0} p(y - D)h(p)dp - \int_{p_0} pE^p h(p)dp \tag{6}$$

where t^c is the corporate tax rate. Equation (6) takes into account that dividends are not deductible for corporate tax purposes. Further, since transfers to the firm are taxable, it is required that

$$E^p \geq 0, \quad \forall\, p \geq p_0 \tag{7}$$

It is optimal to design the financial structure to eliminate the firm's incentive to misallocate the project input. This is true since the firm's gain from this activity, ν, is by assumption less than the project's liquidation value, ω.[7,8] Accordingly, the following set of incentive

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[7]Ex ante it is preferable to arrange to liquidate when the firm has an incentive to misallocate funds (as opposed to simply letting the firm misallocate); expected project surplus is higher since $\omega > \nu$.

[8]We have assumed for simplicity that ω and ν do not vary with the aggregate state. What is critical for our results is that ω and ν are less procyclical than expected project earnings from operating honestly. For example, think

constraints are relevant:

$$(1-t^c)\ p(y - D) - pE^p \geq \nu, \quad \forall\ p \geq p_0. \tag{8}$$

The left side of condition (8) is the firm's expected gain from honestly proceeding with the project, conditional on the aggregate state's being p. The right side is the gain from cheating. Note that condition (8) implies a separate incentive constraint associated with each aggregate state in which it is feasible for the firm to continue operating (i.e., for each $p \geq p_0$). This is because the firm has the option of cheating after aggregate conditions are known. It suggests that, excepting possibly for tax considerations, the optimal financial structure will allow for payments contingent on the common disturbance.

III. EQUILIBRIUM

If we define

$$x \equiv 1/(1-t^c)$$

$$z \equiv (1-t^e)/(1-t)$$

then a more compact statement of each firm's contracting and investment problem is:

$$\max_{\{D, E^p, p_0\}} \int_{p_0} p(y - D)h(p)dp - \int_{p_0} pxE^p h(p)dp \tag{9}$$

subject to

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of the economy as consisting of a cyclical and a non-cyclical sector. Capital may be shifted (at a cost) between sectors.

$$\int_{p_0} p(D + zE^p)h(p)dp + H(p_0)\omega = r \tag{10}$$

$$p(y - D - xE^p) \geq x\nu \quad ; \; p \geq p_0 \tag{11}$$

$$E^p \geq 0 \quad ; \; p \geq p_0 \tag{12}$$

and the feasibility condition, $p_0 \geq \underline{p}$. Equations (9), (11), and (12) correspond to (6), (7), and (8), respectively. Equation (10) is obtained by combining constraints (3) and (4) to eliminate ψ. The weights x and z reflect the relative corporate and personal tax treatment of equity.

Since all firms are identical ex ante and since r is given exogenously, an equilibrium is defined by a vector $\{D, E^p, p_0\}$ that solves the above problem. Ex post output per firm is py if $p \geq p_0$, and it is 0 if $p < p_0$.

In sction IIIA below, we analyze the equilibrium when x = z. In this benchmark case there is no tax bias against equity; the effective surtax on equity at the corporate level is completely offset by the effective subsidy at the personal level. We then turn in section IIIB to the case where x exceeds z, implying a net tax disadvantage to equity. For pedagogical purposes, we begin by arbitrarily precluding renegotiation of debt; however, in section IIIC we drop this restriction.

IIIA. Case 1: No Tax Bias Against Equity (x = z). Substituting equation (11) into the objective (10) yields the following expression for the firm's expected after-tax profit, $\Pi(p_0)$:

$$\Pi(p_0) \equiv [\int_{p_0} py\, h(p)dp + H(p_0)\omega - r]/x \tag{13}$$

Maximizing expected profits thus corresponds to minimizing p_0.

The capital structure which minimizes p_0 concentrates the firm's obligations in good aggregate states, to the maximum extent feasible. Each incentive constraint in equation (11) defines a ceiling on the sum of expected debt and equity payments, one corresponding to each macroeconomic state p. The "state p" ceiling equals the difference between expected output and the gain from cheating, $py - x\nu$. Since this difference increases with p, the ceiling is higher the better the aggregate state. The firm thus gains by shifting its expected obligations to good aggregate states. Doing so allows it to promise less to creditors in bad aggregate states, making it feasible to operate at lower values of p. Minimizing p_0 therefore implies offering to creditors the maximum incentive-compatible expected payment in each state $p \geq p_0$. In any optimum (with $p_0 > \underline{p}$), therefore, the "state p" incentive constraint binds.

The optimal value of p_0 is computed simply by integrating over the incentive constraints and making use of (10) to eliminate D and E^p from the expression; it is accordingly the minimum p_0 which solves

$$\Pi(p_0) \geq [1 - H(p_0)]\nu \qquad (14)$$

The optimal p_0 is therefore the minimum value at which the firm's expected gain from managing its investment honestly (the left side of equations (14)) exceeds its expected gain conditional on cheating.

Figure 1 illustrates the outcome. The *ep* (for "expected profit") curve portrays $\Pi(p_0)$, and the *gc* (for "gain from cheating") curves portrays $[1 - H(p_0)]\nu$. Both curves slope downward. Figure 1 portrays the optimum as the minimum $p_0 \geq \underline{p}$ at which the *ep* and *gc* curves intersect. For realizations of p below p_0, it pays for the debtholders liquidate since the firm since has the incentive to cheat if it is allowed to proceed. If $\Pi(\underline{p}) \geq [1 - H(\underline{p})]\nu$, the first-best outcome is attainable. Since the *ep* curve lies above the *gc* curve at $\underline{p}$ in this case, it is feasible to set p_0 equal to $\underline{p}$. Conversely, if $\Pi(\underline{p})$ is sufficiently smaller than $[1 - H(\underline{p})]\nu$ then the *ep* and *gc* curves need not intersect, implying that no solution exists for p_0. In this instance, agency problems preclude investment altogether.

When the incentive constraints bind, the optimal financial structure is a mixture of debt and equity, with equityholders absorbing the aggregate risk. In the limiting case in which the firm just escapes liquidation (i.e., when $p = p_0$) payments to equityholders are cut to zero. The expected obligation to bondholder equals the maximum liability afforded by the incentive constraint. D is thus found by setting E^{p_0} equal to zero in the "state p_0" incentive constraint:

$$D = y - x\nu/p_0 \tag{15}$$

Clearly, if p falls below p_0, the firm's expected debt liability exceeds the ceiling permitted by the incentive constraint. In this situation, the bondholders liquidate the firm and receive ω.

A relation for E^p is obtained by using (15) to eliminate D in each "state p" incentive constraint:

$$E^p = (1/p_0 - 1/p)\nu \tag{16}$$

E^p is clearly increasing in p; payments to equityholders vary positively with macroeconomic conditions. The key point is that a "macroeconomic" effect on dividends arises, operating independently of the firm's ex post earnings performance. It arises because the primary role of equity here is to provide the firm with insurance against changing aggregate conditions.

IIIB. <u>Case II: Tax Bias Against Equity (x > z)</u>. We now suppose that x exceeds z, reflecting a net tax bias against equity. It turns out that in this situation firms effectively choose between two different financing regimes. One is the kind of mixed debt-equity structure described in the previous section. The other is exclusive use of debt. We describe each possibility, in turn.

The outcome in the mixed debt-equity regime has the same structure as the previous case. Equations (14), (15), and (16) still determine p_0, D, and E^P. The only difference is that $\Pi(p_0)$ is now given by equation (17), rather than equation (14):

$$\Pi(p_0) = [\int_{p_0} py\, h(p)dp + H(p_0)\omega - r]/x - [(x - z)/x]\int_{p_0} pE^P\, h(p)dp \qquad (17)$$

Expected profits now incorporate the impact of the effective surtax on equity, reflected in the second term in equation (17).[9] A rise in the tax wedge $(x - z)/x$, holding x constant, ultimately increases the firm's exposure to aggregate risk. p_0 increases because the added cost of equity induces greater reliance on debt. In terms of Figure 1, the reduction in expected profits owing to the rise in $(x - z)/x$ shifts the *ep* curve downward, raising p_0.

The tax subsidy opens the possibility that the firm may opt for pure debt. Let p_o^d denote the the reservation value of p for this case. To compute the optimum under pure debt, note that only the state p_o^d incentive constraint may bind. Since debt may not be indexed to the aggregate state, the incentive constraints for $p > p_o^d$ are always slack. Combining the state p_0^d incentive constraint with the pure debt version of equation (10) implies p_o^d is given by

$$\Pi^d(p_o^d) \geq (\hat{p}^d/p_o^d)[1 - H(p_o^d)]\nu \qquad (18)$$

[9]Note that the tax wedge, $(x - z)/x$, is just $1 - [(1-t^e)(1-t^c)/(1-t)]$, the net tax subsidy to debt finance often analyzed in the public finance literature.

where $\hat{p}^d$ is the expectation of p conditioned on $p \geq p_0^d$, and with expected profits, $\Pi^d(p_0^d)$, defined by

$$\Pi^d(p_o^d) = [\int_{p_d} py\ h(p)dp + H(p_o^d)\omega - r]/x \tag{19}$$

Figure 2 illustrates the trade off between the pure debt and mixed regimes. The ep^d and gc^d curves portray the left and right sides of equation (18), respectively. The optimum under pure debt finance corresponds to the intersection of these two curves with the lowest value of p_o^d. The optimum under mixed debt-equity finance is portrayed the same way as in Figure 1, except that the *ep* curve now reflects equation (17) rather than equation (13). Exposure to macroeconomic risk is always greatest under pure debt finance; that is, $p_0^d > p_0$ in Figure 2.[10] A fully levered firm faces a greater prospect of liquidation because it is unable to concentrate its obligations in good aggregate states. A firm may nonetheless opt for pure debt. Because of the tax asymmetry, $\Pi^d(p^d)$ may still exceed $\Pi(p_0)$.

Factors beyond the tax wedge affect the capital structure choice. A rise in either the mean project return or in the project liquidation value increases the relative attractiveness of debt. The same is true for a reduction in macroeconomic risk. As the macroeconomic risk converges to zero, pure debt finance becomes optimal: Though the idiosyncratic risk may remain large, both incentive and tax considerations dictate that the optimal contract is pure debt. This kind of result differs from the traditional public finance literature, which does not distinguish the significance of aggregate versus idiosyncratic risk.

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[10] It is straightforward to verify that the gap between the gc_d and ep_d curves always exceeds the corresponding gap between the *gc* and *ep* curves, implying that p_0^d must always exceed p_0.

IIIC. The Possibility of Renegotiation. If p falls below p_0, each firm and its debtholders may be willing to renegotiate a deal that permits the project to continue. In this subsection we reconsider the contracting problem in light of this possibility. As we will demonstrate, the basic insights from the previous analysis remain intact.

Assume that upon threat of liquidation, firms are able to make take-it-or-leave-it offers to debtholders. Giving bargaining power to firms in this situation is in accord with how Chapter 11 of the U.S. bankruptcy code influences bargaining positions for debt renegotiation (see the discussion in Gertner and Scharfstein, 1989).[11] This assumption is mainly for convenience of exposition, however. It turns out that the division of ex post bargaining power does not affect the optimal reservation value of p. Nor does it affect the division of expected surplus between the firm and its lenders. Also, for pedagogical purposes, assume there is no subsidy to debt finance, i.e., $x = z$: Extension to the case with $x > z$ is straightforward.

Define p_r as the value of p_0 at which the expected return to debtholders conditional on not liquidating equals their gain from liquidating, i.e., the value of p_0 at which $p_0 D = \omega$. From equation (15), p_r satisfies $p_r y - \omega = \nu$, or equivalently,

$$p_r = (\omega + \nu)/y \qquad (20)$$

If $p_0 \leq p_r$, renegotiation never occurs and the equilibrium corresponds exactly to the case where renegotiation is arbitrarily precluded. Suppose that p lands below p_0. Since $p_0 < p_r$, $pD < \omega$. The liquidation value thus exceeds any feasible expected return on renegotiated debt. This is true since

[11] That for some period (a minimum of 120 days) the debtor in possession has control of the firm's assets and the exclusive right to offer plans for reorganization implies that claims are realigned in favor of inside equity.

the firm cannot make an offer exceeding D without violating the incentive constraint. Bondholders will therefore never opt to renegotiate. Equations (14) through (16) thus continue to characterize the outcome. Figure 3a illustrates this case.

Now suppose $p_0 > p_r$. Bondholders will renegotiate if p lands in the interval $[p_r, p_0)$, since $p \geq p_r$ implies $pD \geq \omega$. In this situation, the firm offers bondholders an expected return equal to their reservation price ω for the right to continue. Since the offer is "take it or leave it," the bondholders accept. Renegotiation thus alters the outcome in this case by making p_r the effective reservation value of p.[12] Note, however, that inefficient liquidations may still occur since bondholders will refuse to renegotiate whenever p falls below p_r. Equation (3) implies that $p_r > \underline{p}$, so that inefficient liquidations can still occur with positive probability. Figure 3b illustrates this case.

Financial distress here cannot be resolved in this case by simple conversion to equity, an oft-proposed solution. Resolving distress instead requires a net transfer from the bondholders to the firm. The firm's expected obligation must be reduced to the point where it no longer has an incentive to misallocate. Bondholders may not be willing to do this, especially if their gain from liquidation is relatively large.[13]

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[12]The solutions for p_0, D and E^P remain the same in this case. Because they still receive ω whenever $p \leq p_0$, bondholders expected return remains $\int_{p_0} pD\, h(p) + H(p)\omega$. The constraints (10) - (12) thus remain unaffected. The only difference in the contracting problem is that $\Pi(p_r)$ replaces $\Pi(p_0)$ as the objective since the firm gets the expected surplus $py - \omega$ for all $p \in [p_r, p_0)$. It is straightforward to verify that equations (14) - (16) still determine p_0, D, and E^P.

[13]Note also that our analysis overstates the likelihood of successful renegotiation by abstracting from a number of the practical problems. See our (1990) paper for a discussion of the effective costs of renegotiating

IV. EMPIRICAL IMPLICATIONS

In this section we examine some empirical predictions of the model. Perhaps the key feature of our theory is the role of equity as a means of sharing aggregate risks. This leads to the prediction that payments to equityholders should vary with macroeconomic conditions, everything else equal regarding the firm's performance (see equation (16)). In section IVA below we present some formal evidence supporting the notion of an independent macroeconomic effect on dividends. Another important implication, related to the role of equity in sharing aggregate risks, involves the connection between corporate capital structure and the cyclical behavior of business failures; we address this issue in section IVB. In section IVC we present some facts on the relative cyclical patterns in dividends and interest payments as a way to quantify the historical importance of equity as a cushion against cyclical risks. This exercise also allows us to draw quantitative inferences about the recent shift to leverage for the equity cushion. Finally, in section IVD we assess at a qualitative level whether our model is compatible with the increase in corporate debt during the 1980s by taking account the behavior of taxes and other factors affecting the choice of debt in our model.

IVA. The Macroeconomic Effect on Dividends. We now test the prediction of equation (16), that macroeconomic conditions should influence payments to equityholders, even independently of the firm's earnings performance. We confront a number of issues in performing this test. First, and most significantly, our model is too stylized to take to directly to data. We therefore adopt an econometric specification designed to capture the basic idea. We modify a conventional empirical dividend model to allow for the possibility of a macroeconomic effect. Second, since how "macroeconomic

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corporate debt in the U.S.

conditions" should be measured is an open question, we use a variety of measures. Finally, it is important to control for the possibility that macroeconomic variables may matter statistically simply because they contain news about future earnings performance that is not already contained in firm-specific variables. We approach this problem in two ways: first, when possible, by only allowing the macroeconomic variables to enter one period lagged after the firm-specific variables; second, by allowing the firm's contemporaneous stock price to enter.

The data we use are annual and consist of information on a panel on on manufacturing corporations drawn from Standard and Poor's COMPUSTAT industrial file from 1970 to 1989.

The econometric framework is a a variant of Lintner's (1956) famous partial adjustment framework. We experiment with specifications of the form

$$D^{*}_{it} = a_i + bY_{it} + cM_t + e_{it} \tag{21}$$

where D^{*} is the desired dividend payout, with i and t denoting the firm and the time period, respectively; a is fixed firm effect; Y_{it} reflects firm specific economic variables that influence the pay out decision; M_t reflects macroeconomic variables that influence the payout decision[14]; and e_{it} is a white-noise error term. All firm-specific variables are expressed in per share terms.[15]

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[14]Strictly speaking, our model only makes predictions about adjustments in the total present value of dividend payouts in the wake of a change in macroeconomic conditions, as opposed to predictions about exact timing. However, all that is necessary for our empirical predictions is that at least some of the adjustment in dividends closely follows the movement in macroeconomic conditions.

[15]A logical alternative is to use logs of the relevant variables. In the COMPUSTAT data, unfortunately, there are sufficiently many negative observations for key firm-specific variables, such as earnings, to make this

Following the literature, we assume partial adjustment of dividends:[16]

$$D_{it} - D_{i,t-1} = \lambda(D^{*}_{it} - D_{i,t-1}) \qquad (22)$$

Using (21) to eliminate D^{*}_{it} in (22) and then first differencing to remove firm-specific effects yields

$$\Delta D_{it} = (1-\lambda)\Delta D_{i,t-1} + \lambda b \Delta Y_{it} + \lambda c \Delta M_{t} + \varepsilon_{it} \qquad (23)$$

where $\varepsilon_{it} = \lambda(e_{it} - e_{i,t-1})$.

We take as the null hypothesis the conventional Lintner-type model, with c = 0. The alternative we offer, suggested by equation (16), is that c should differ from zero; that is, everything else equal regarding the firm's performance, dividends should vary with macroeconomic conditions.

There are two ways in which to interpret equation (23). One is as a structural model. The other, which we prefer, is simply as a reduced form. Our strategy then should be interpreted as testing whether macroeconomic factors should matter in the reduced form, after controlling for all the relevant firm-specific variables.

We use two kinds of proxies for macroeconomic conditions. The first is set of year dummies. This effectively amounts to allowing for a time varying intercept which is common across firms, and interpreting movements in the intercept as the "macroeconomic effect." Using year effects allows us to be agnostic about the source of aggregate shocks relevant to dividend behavior. It also allows us to abstract from problems of timing and measurement error. The disadvantage is that it does not provide us with a precise metric against which to judge the extent to which movements in the intercept are truly driven

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choice unattractive.

[16]See also the review of studies in Poterba (1987).

by macroeconomic factors. The second approach, therefore, is to include a macroeconomic variable directly in the regression.

We begin with a set of regressions that use year dummies to reflect macroeconomic conditions. The term $\lambda c\Delta M_t$ in equation (23) is treated as as time-varying intercept. We then estimate three different versions. The first uses contemporaneous firms earnings per share, E_{it}, as the measure of the firm-specific effect on the desired dividend pay out, Y_{it}.[17] The second adds the contemporaneous firm stock price per share, S_{it}, to the set of firm specific variables to control for the possibility that the year dummy is simply contains news about the firm's fortunes that is not reflected in the its current earnings. The last version controls for the possible influence of tax changes on the estimated year effects. We allow the dividend payout parameter conditioned on firm-specific events (b in equation (23)) to vary with the tax price of dividends at the shareholder level. That is, we let

$$b = b_0 + b_1 TAX_t \tag{24}$$

where TAX is the ratio of the after-shareholder-tax value of a one-dollar dividend payout to the after-shareholder-tax value of a capital gain.[18] This specification allows for the possibility that an additional common effect, from the tax system, influences payout. An increase in the tax rate on dividend distributions relative to the effective tax rate on capital gains decreases TAX. We estimated hybrids of these three versions, but since they

[17] Using lagged earnings instead of contemporaneous earnings in estimating (23) produces virtually identical results. We opted for contemporaneous rather than lagged earnings to ensure that the firm-specific variable contains as much news as possible about future earnings.

[18] That is, TAX = $(1-\theta)/(1-c)$, where θ and c are average effective shareholder tax rates on dividends and capital gains, respectively. To calculate TAX, we updated the series reported in Poterba (1987).

do not suggest any important changes, we do not report the results.

Table 1 and Figure 4 report the results for the three regressions using the year effects as the macroeconomic variable. Table I presents the estimated coefficients and significance levels for the firm-specific variables in each regression, and also reports the significance level of the year dummies.[19] Figures 4a - 4c plot the estimated year effects for each of the three cases.

The year effects are highly significant in each case, indicating the presence of a statistically significant common effect on dividends, after controlling for the influence of conventional firm-specific factors.[20] Importantly, the estimated patterns in the year effects are procyclical, rising in upturns and falling in downturns. And this pattern holds across specifications. In all three cases, pronounced troughs occur in 1975 and 1983, the wakes of the two previous recessions. It is also true that a dip occurs in 1987, not a recession period. However, GNP growth was below trend in the latter part of 1986, indicating less than desirable macroeconomic performance.

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[19]Because the model is a reduced form, we restrict our interest to whether the macroeconomic effect is significant, and forego any attempt to interpret the coefficients on the firm-specific variables. Note also that the possible auto-correlation in the error term, which is a consequence of the differencing to remove the firm-specific effect, is likely to bias the coefficient on lagged dividends. It does not, however, bias the estimated macroeconomic effect.

[20]Though we do not report them here, we found similar results using a probit specification to model dividend cuts. The probit specification was motivated by the idea that dividend cuts may be reasonably approximated as discrete events. We modeled the probability of a dividend cut as a function of percentage changes in firm earnings and the stock price and year effects. The firm-specific variables were statistically significant with the intuitive effect (increases in firm earnings or stock prices reduce the probability of a dividend cut). But, importantly, the year effects were also statistically significant and countercyclical in magnitude: Holding constant firm-specific influences, the probability of a dividend cut rises in recessions. The results hold whether dividend cuts are modeled as nominal or real.

As a way to confirm our interpretation that aggregate conditions are responsible for the estimated patterns in the year effects, we reestimate the three versions of the model, this time using a macroeconomic variable, the percentage change in real GNP, instead of the year dummies. The macroeconomic variable is entered lagged one period, along with contemporaneous values of the firm-specific variables. We use the lagged value of the macroeconomic variable to minimize the possible news effect. The lag specification also seems reasonable given that it takes time for precise information about GNP to unfold (especially given data revisions).

Table 2 presents the results. The coefficient on the lagged percentage change in GNP is positive across the three specifications, and precisely estimated. The estimated coefficient is robust to the three specifications. These results confirm that the common effect present in the first set of regressions is connected with the business cycle. We also tried two alternative variables to proxy macroeconomic conditions, corporate profits and the unemployment rate, and found similarly that these variables had significant predictive in the dividend regression.

Conventional models of dividend behavior cannot easily explain these results. Models which predict simply that dividends vary with earnings cannot explain an independent macroeconomic effect. These models predict only that dividends should vary positively with firm-specific measures of profitability. To the extent it is possible to control for all of the relevant firm-specific factors, macroeconomic variables should not have independent predictive power. Dividend models based on signaling theories do not in general yield this result.[21] Taking these models literally, a firm a firm needs only to signal

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[21]Bhattacharya (1979) is a seminal paper on the signaling theory of dividends. In a different vein, Easterbrook (1984) has suggested that periodic payments to equityholders serve as a mechanism for exposing managers to capital-market

about its performance relative to the mean. Because information about common movements in firm profitability is publicly available, there is no reason to use dividends to signal changes in aggregate conditions. Hence, there is no reason for an independent macroeconomic effect on dividend behavior.

IVB. Involuntary Business Liquidations. Whenever p drops below p_0, debtholders sue to liquidate the firm. Our model therefore predicts that involuntary liquidations should be countercyclical. Further, given that p_0 is determined jointly with financial structure, the model also predicts a relation between financial structure and the pace of involuntary liquidations. Equation (15), in particular, predicts a positive relation between debt and the expected number of involuntary liquidations (holding constant output conditional on success, y, and the gain from cheating, ν).

A frictionless model could explain countercyclical voluntary business exits, but it cannot explain countercyclical involuntary liquidations, particularly if they involve efficiency costs, as they do endogenously in our model. Because the Modigliani-Miller theorem holds in a frictionless setting, this kind of framework also has difficulty explaining how an increase in leverage could induce a rise in the business failures. These predictions are easily generated, of course, in a model that arbitrarily restricts the form that financial contracts can take, say to non-indexed debt. Typically, though, any predictions about debt and the cyclical behavior of liquidations disappear once one permits the financial contracts to be indexed to aggregate variables. A satisfactory model of recessions and financial distress must provide some rationale for why this indexing does not emerge. In our framework, institutional features of the tax code play an explicit role in

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discipline to avoid non-value-maximizing uses of internal funds. This approach also does not predict an independent macroeconomic effect on dividends.

dampening the incentive index financial contracts to aggregate cyclical variables, effectively by dampening the incentive to use equity.

Figure 5 plots times-series data for the postwar on liabilities of business failures as fraction of GNP, taken from Dun and Bradstreet. (See Friedman (1990) for a related discussion of these data.) Unfortunately, the failure data do not separate involuntary from voluntary exits.[22] Thus, while the pattern is clearly countercyclical, this evidence alone is not inconsistent with a perfect-markets setting. However, as Friedman (1990) has observed, there is a dramatic shift in the failure rate that coincides with the increase in corporate leverage. The ratio of liabilities of business failures to GNP increases more than fourfold over the 1980s, despite the sustained business expansion that begins in 1983. A perfect-markets model would have difficulty explaining such a sharp change in the business failure rate, as well as the strong correlation of this change with the increase in corporate leverage.

The rise in the failure rate also casts doubt on the view that most corporate debt is effectively "equity in drag." The potential for renegotiation alone does not imbue debt with all the effective features equity. As our model suggests, even when costless renegotiation is feasible, debt may not perfectly supplant equity as a device for sharing aggregate risks.

IVC. <u>The Equity Cushion</u> We now present some evidence on the cyclical behavior of dividends relative to interest payments. The objective is to gain some quantitative sense of the degree to which equity is used for sharing aggregate risk. This exercise also leads us to a measure of financial

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[23] Dun and Bradstreet defines a "failure" as the exit of a business involved in court proceedings or an exit by voluntary actions involving losses to creditors.

distress supplementary to the ratio of interest payments to cash flow, the measure suggested by Bernanke and Campbell (1988) and others.

Figure 6 plots the level of dividends relative to net interest payments, using the quarterly postwar NIPA data. The most immediate feature is the secular decline in this ratio, owing to the shift to debt finance. The mean value is 2.53 over the postwar period, but shrinks to 0.81 over the decade of the 1980s. For comparison, we also plot the ratio of cash flow to interest, the inverse of the "Bernanke-Campbell" ratio. Not surprisingly, the secular behavior of these two ratios is closely related: The raw correlation is .974.

To isolate the cyclical from the secular movement in dividends relative to interest we apply the detrending procedure suggested by Hodrick and Prescott (1980). Figure 7 plots the detrended series. Pronounced troughs appear around 1958, 1970, 1975, and 1982, times which either precede or coincide with NBER dated recessions.[23] In assessing the aggregate risk sharing role of equity, the last three episodes are probably the most comparable, since the secular value of the dividend to interest ratio was relatively stable over this period (see Figure 6). In the last three episodes, the ratio of dividends to interest fell about 25%.

To gauge the the relative size of the cycical variation in the dividend-to-interest ratio, we also report the similarly detrended ratio of cash flow to interest. Naturally, troughs also occur around recession periods in this series. Judging from the last three episodes, they are slightly less than twice the size in percentage terms of the drop in dividends relative to interest. This accords with the raw correlation between the two detrended

[15]The behavior of the dividend-interest ratio is robust to using lagged interest payments in the denominator; hence contemporaneous fluctuations in short-term nominal interest rates are not accounting for the cyclical movements in the series.

ratios, which is .603. Presuming that total interest obligations are relatively stable over the cycle, these results suggest that, historically, roughly over half of the cyclical drop in corporate cash flows was met by a drop in dividends. Taken in conjunction with our earlier results that indicate that dividends respond to macroeconomic conditions independently of firm-level variables, this evidence suggests that the aggregate risk sharing role of equity may be considerable.

The ratio of dividends to interest supplements the use of the ratio of interest payments to cash flow as a measure of financial distress. In this regard, the secular decline in the "equity cushion" is another symptom of the financial vulnerability of firms. Given that this ratio has fallen to about 0.6, and given the historical magnitude of declines in this ratio during recessions, it is clear that corporations face greater exposure to macreconomic risk. These arguments, of course, hinge on the interpretation of "debt's being debt," and not effectively "equity in drag." Our model suggests, however, that debt in general never perfectly substitutes for equity as vehicle for sharing aggregate risks.[24]

IVD. The Increase in Corporate Debt. Finally, is our simple model compatible with the debt build-up of the 1980s? Obviously, the model is too stylized to make quantitative statements. However, three events occurred in the 1980s, each which would lead to increased use of debt in the context of our model. The first was a rise in the tax subsidy to debt. However, while the combined effect of the 1981 and 1986 tax reforms probably increased the tax bias against equity finance, it is unlikely that this effect alone was

[24] Innovations over the last decade have increased the flexibility of debt. Our argument is only that, while debt may now be a closer substitute for equity as a device to share aggregate risk, it cannot become a perfect substitute so long as the institutional restrictions of the tax code remain.

large enough to provide a complete explanation (see Gordon and MacKie-Mason, 1990; and our 1990 paper.)

Another possible factor is improved macroeconomic conditions. In our framework, a rise in either the mean of the aggregate shock or a reduction in the risk (i.e., a mean-preserving "narrowing" of the distribution) reduces the need for equity, thereby increasing firms' incentives to take advantage of the tax subsidy to debt. To the extent the business expansion of the 1980s is captured by this simple abstraction for improvement in macroeconomic conditions, our framework would suggest that it provided a climate conducive to growth in debt finance. This explanation is also compatible with the fact that many firms have begun shifting back to equity finance in the recent period of deteriorating aggregate economic conditions.

A final possibility is the improved liquidity of corporate assets owing to the relaxation of antitrust laws and the increased participation by foreign investors, as suggested by Shleifer and Vishny (1990). In our model, an increase in firms' liquidation value similarly makes debt more attractive by reducing the risk. An additional effect is that debtholders' incentive to renegotiate declines, possibly raising the cyclical sensitivity of involuntary business liquidations (see the discussion in section IIC). Thus, the story is capable of explaining both a rise in debt and an increase in the pace of business failures.

It is difficult, however, to separate entirely the latter two explanations of debt growth from tax considerations. Both improvement in macroeconomic conditions and in firm liquidation values potentially reduce the agency costs of external finance in our framework. Absent the institutional considerations of the tax code, however, these factors cannot explain why firms would choose to increase their exposure to macroeconomic risk. If they did not have to forego the tax subsidy, the firms in our model would always opt for a financial structure with greater insulation against aggregate risks.

V. CONCLUDING REMARKS

Our model, we think, is in keeping keeping with the *Wall Street Journal* intuition that equity provides firms with a cushion against aggregate fluctuations, and, relatedly, that firms are more likely to cut dividends in recessions, when other firms are doing the same, everything else equal regarding their earnings performance. Specifically, equity in our model allows a firm to share aggregate risks with its creditors, minimizing the chance that a recession could push it into financial distress. We show that the institutional features of the tax code in general preclude debt from perfectly substituting for equity in this aggregate risk-sharing role, even when costless renegotiation is feasible. Overall, the tax bias against equity reduces the extent to which firms insulate themselves against aggregrate risks.

The role of equity in sharing aggregate risks leads to the prediction that individual firm dividends should vary with macroeconomic conditions, after controlling for the effects of all the relevant firm-level variables. We present in support of this prediction, using several different ways to proxy macreconomic conditions. In this regard, both our theortical and empirical analysis may provide an insight into why dividends traditionally appear smooth relative to earnings at the firm-level but variable at the aggregate level (see, e.g., Marsh and Merton,1987; and Poterba, 1987). Regardless of whether one accepts our theory, however, we think that it is important to ultimately explain why macroeconomic variables have signifcant independent predictive power in firm-level dividend equations.

Finally, our model is too stylized to provide any quantitative insight into the costs of excessive leverage. Recent empirical work by Cantor (1990) and Sharpe (1990), however, indicates a significant impact of debt on firm employment volatility. More work along these lines would be useful.

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TABLE 1

Econometric Models of Determinants of Firm Dividend Behavior

(Macroeconomic Conditions Represented by Year Dummies)

Variable	Regression I: Earnings	Regression II: Earnings, Share Price	Regression III: Earnings, Taxes
ΔD_{-1}	-.340 (.011)	-.340 (.011)	-.356 (.011)
ΔE	.025 (.002)	.024 (.002)	.014 (.004)
Δ(Share Price)	-----	.013 (.003)	-----
$TAX \cdot \Delta E$	-----	-----	.018 (.006)
$\bar{R}^2$	.085	.086	.085
F test for excluding year effects	(.0001)	(.0001)	(.0001)

Note: The models (described in the text) were estimated by Ordinary Least Squares using panel data from COMPUSTAT. Heteroskedasticity-consistent standard errors are in parentheses. The estimated year effects are plotted in Figure 8.

TABLE 2

Econometric Models of Determinants of Firm Dividend Behavior

(Macroeconomic Conditions Represented by Percentage Change in GNP)

Variable	Regression I: Earnings	Regression II: Earnings, Share Price	Regression III: Earnings, Taxes
Intercept	-.021 (.011)	-.022 (.011)	-.021 (.011)
ΔD_{-1}	-.341 (.015)	-.340 (.014)	-.341 (.014)
ΔE	.015 (.002)	.014 (.002)	.014 (.007)
Δ(Share Price)	-----	.013 (.003)	-----
TAX•ΔE	-----	-----	.014 (.006)
% change in GNP (lagged)	1.05 (.286)	1.17 (.287)	1.05 (.286)
R^2	.083	.085	.083

Note: The models (described in the text) were estimated by Ordinary Least Squares using panel data from COMPUSTAT. Heteroskedasticity-consistent standard errors are in parentheses.

FIGURE 1: DETERMINATION OF P_0 (NO-TAX-SUBSIDY CASE)

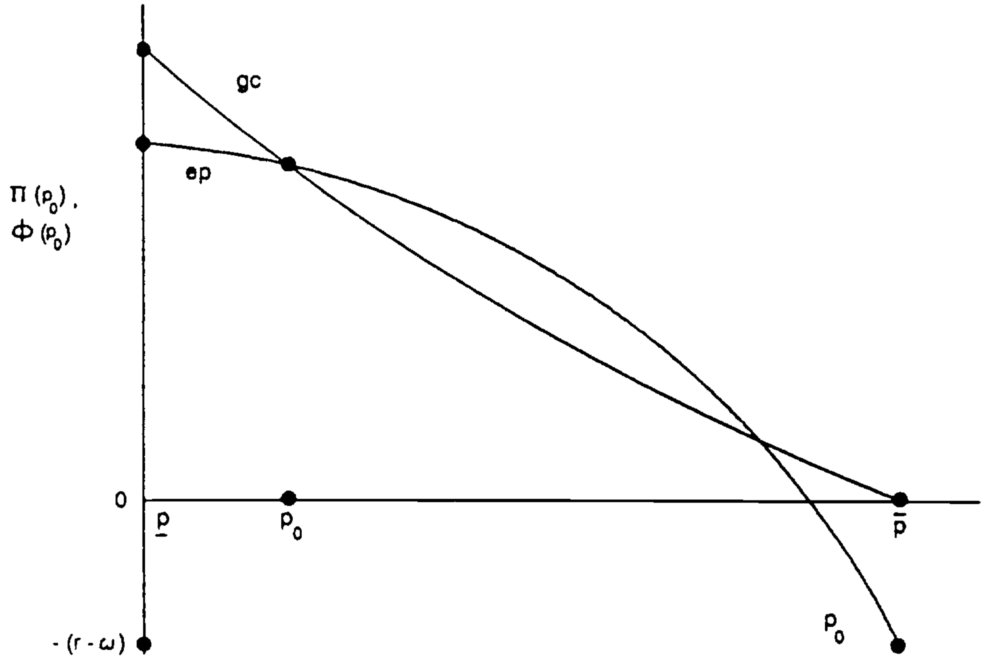


FIGURE 2: DETERMINATION OF P_0 (TAX-SUBSIDY CASE)

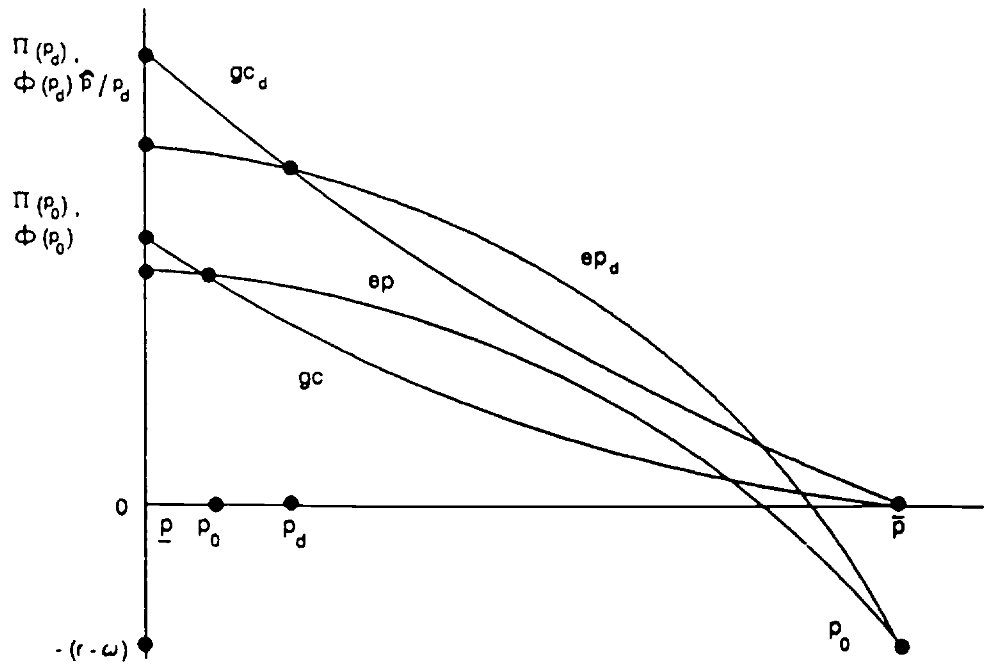


FIGURE 3a: EQUILIBRIUM WITH NO RENEGOTIATION

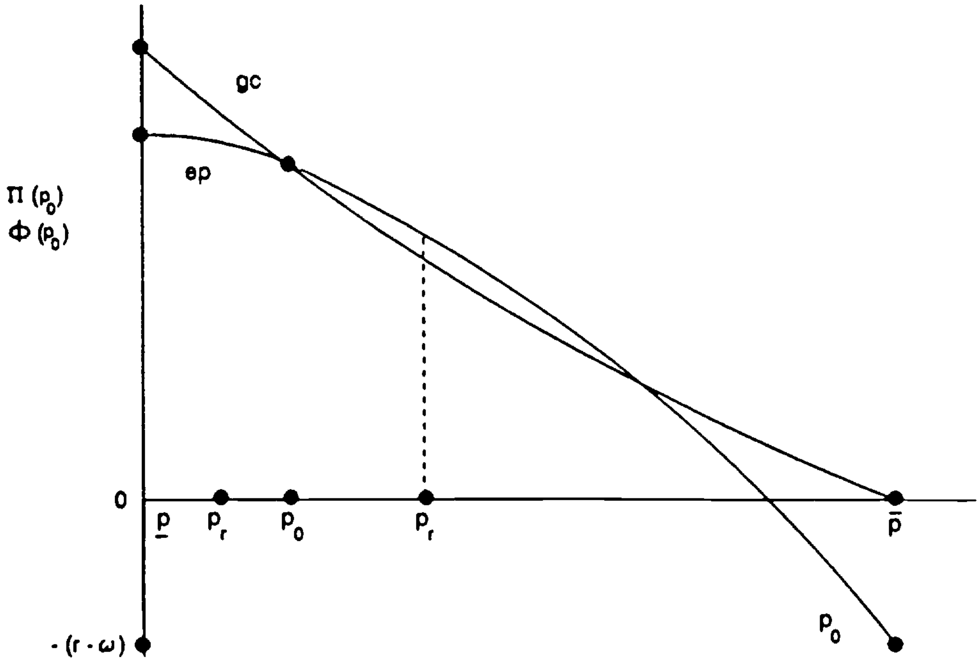


FIGURE 3b: EQUILIBRIUM WITH RENEGOTIATION

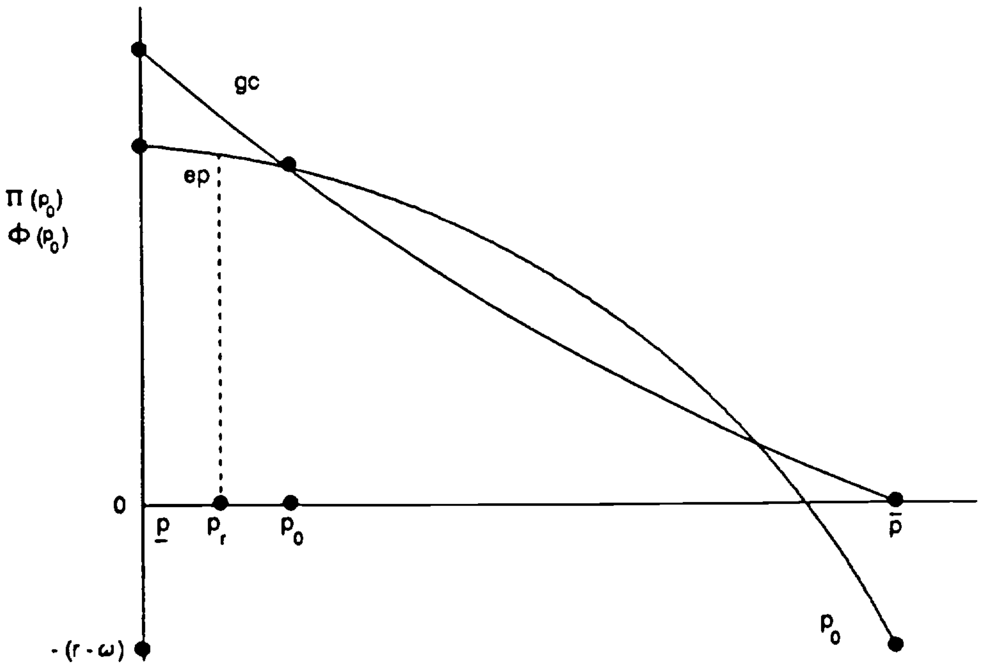
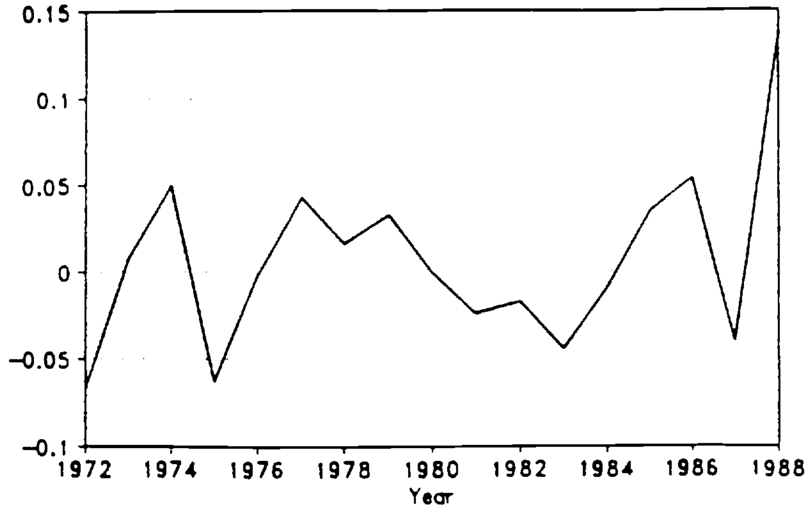


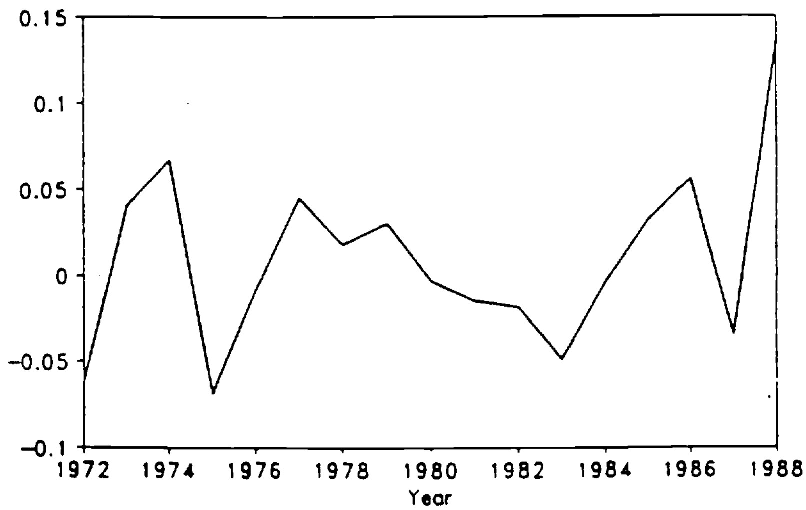
FIGURE 4

Year Effects in Simple Dividend Models

4A



4B



4C

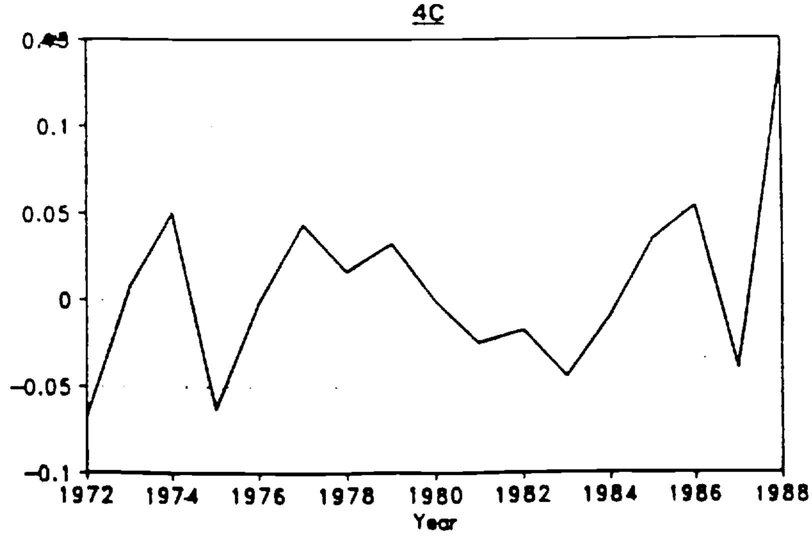
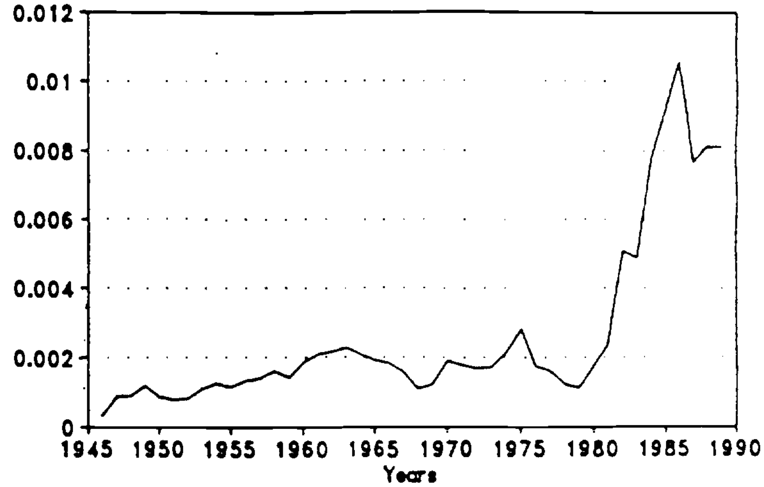
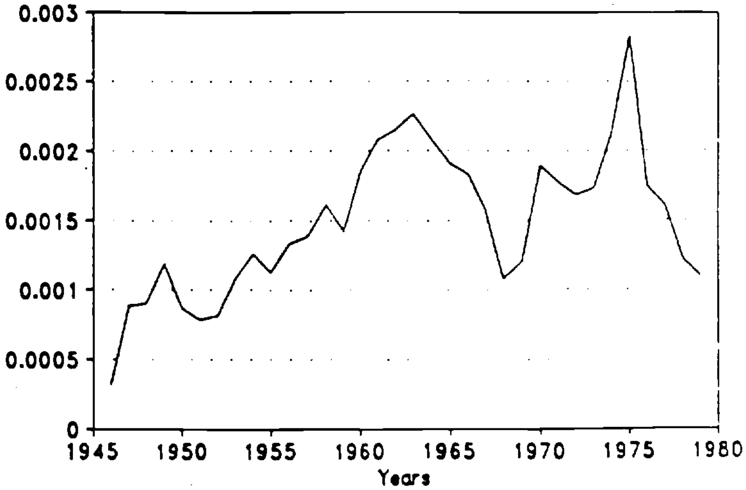


FIGURE 5

LIABILITIES OF BUSINESS FAILURES AS A SHARE OF GNP





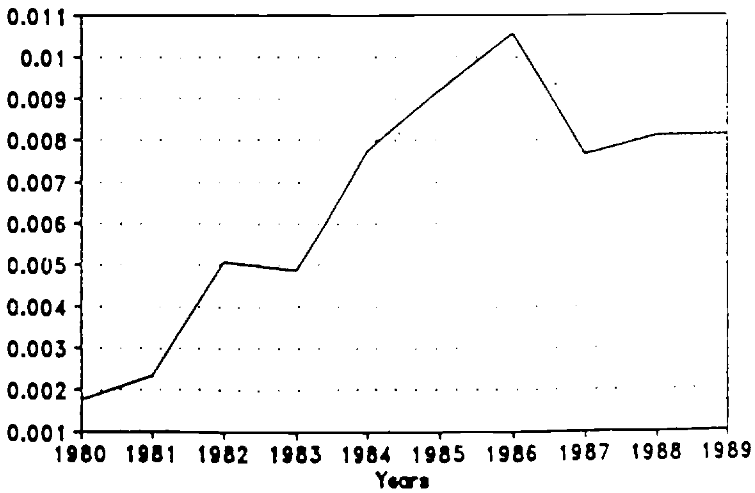


FIGURE 6

DIVIDEND-INTEREST AND CASH-FLOW-INTEREST RATIOS

(Aggregate Time-Series Data)

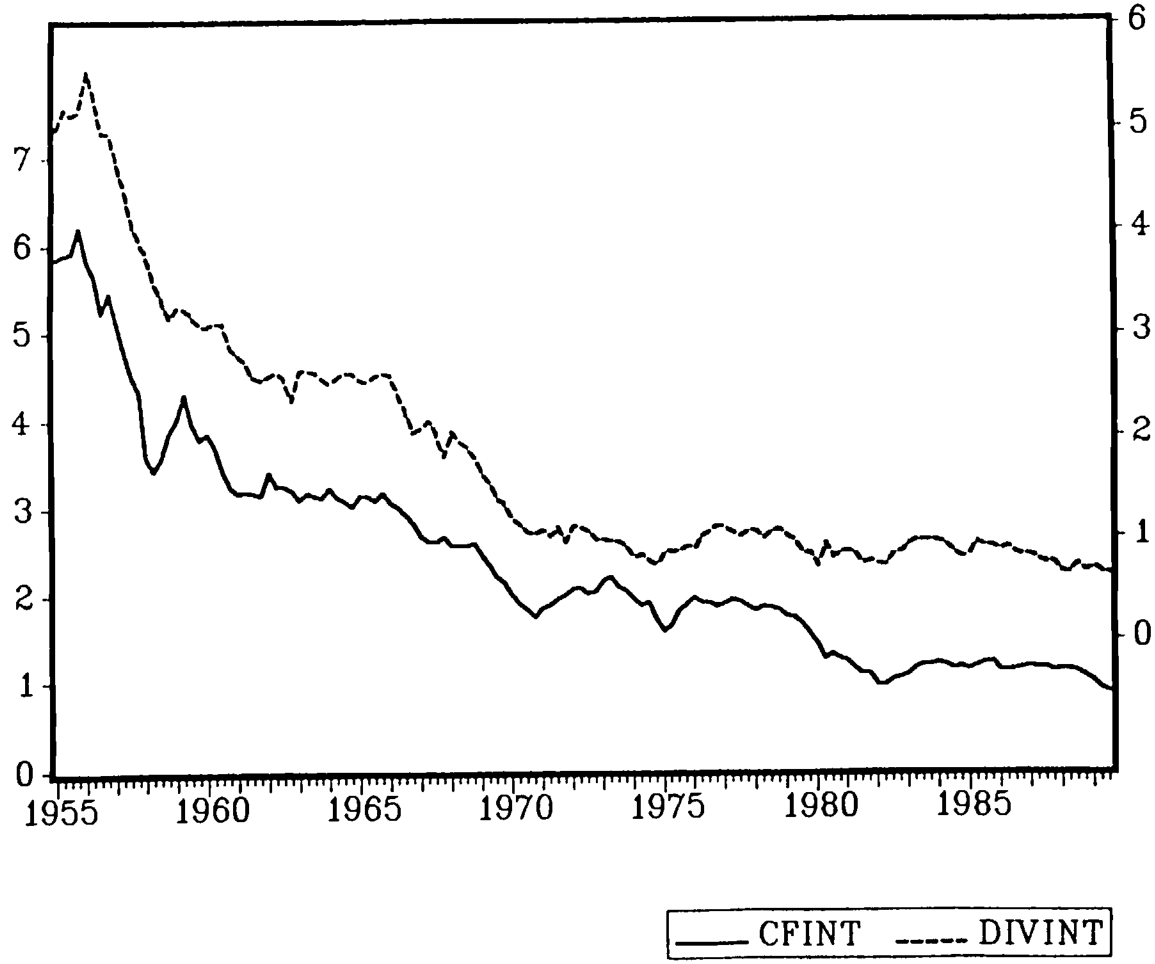


FIGURE 7

DETRENDED DIVIDEND-INTEREST AND CASH-FLOW-INTEREST RATIOS

(Aggregate Time-Series Data)